Global Real Estate Cycle Analysis

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The Scenario - Global Real Estate Cycle

Real estate is a notoriously cyclical industry. The most recent major real estate recession occurred in 2007/2008 in relation to the housing crisis that originated in the United States and rippled across the rest of the globe. Property markets across diverse geographies from Brazil to China to Portugal felt the impact of contracting capital markets and to varying degrees experienced follow on downturns. While many of these localized negative market epochs have been studied at length, there is more limited discussion and understanding surrounding the nature of global real estate cycles and their characteristics. This project seeks to move beyond the traditional binary paradigm of “recession” vs “growth” periods, and develop a more nuanced approach for discussing :

- How the global real estate market has performed over the past 5 years;
- Whether market periods might be grouped in a meaningful way; and
- Opportunities for future analysis.

Information Sources

Sourcing global real estate price and additional feature data is challenging given the fragmented nature of the industry within countries, let alone internationally. The primary data sources for purposes of this project include:

- Organization for Economic Co-operation and Development
- Federal Reserve Board of Governors
- International Monetary Fund
- U.S. Bureau of Economic Analysis
- Federal Financial Institutions Examination Council (US)

Information Source - Data Clean Up

Some of the issues encountered and overcame while cleaning the data included :

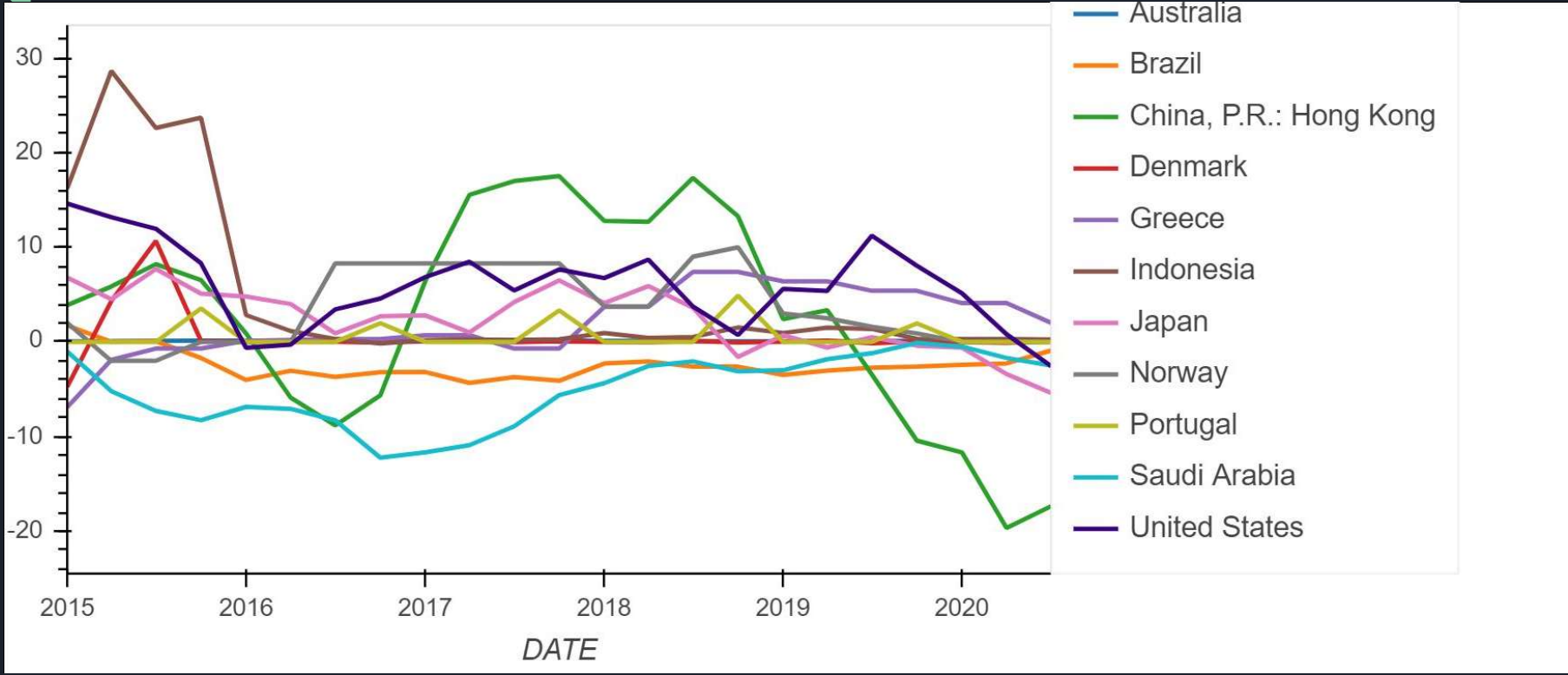
- Inconsistent time periods available for different countries;
- Obtaining a diverse composite of countries; and
- Dealing with null values.

Information Source - Solution

Real estate price change data was eventually complied across the following countries, which represent a reasonably diverse and geographically dispersed basket. In traditional global investment terms developed, emerging, and frontier markets are all represented. The data set compiled covers the time period from 2015 through 2020, on a quarterly basis.

- Australia
- Brazil
- China
- Denmark
- Greece
- Indonesia
- Japan
- Norway
- Portugal
- Saudi Arabia
- United States

Summary Statistics - Real Estate Price Data (quarterly)

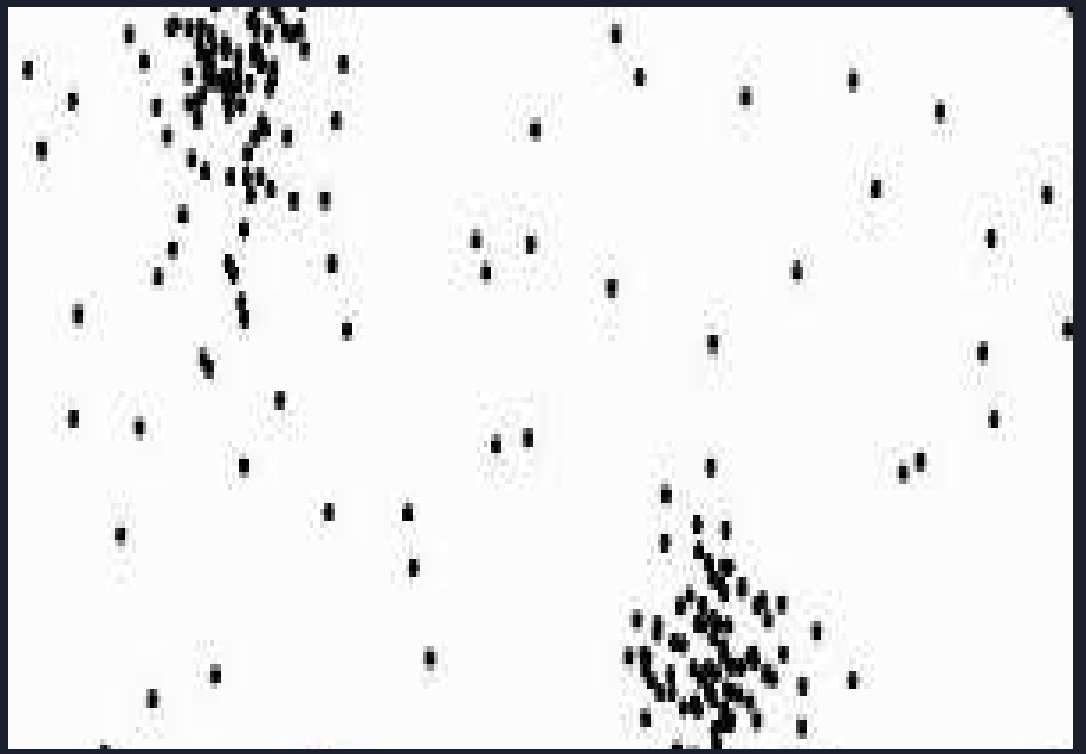


How to find clusters? - K-means Clustering

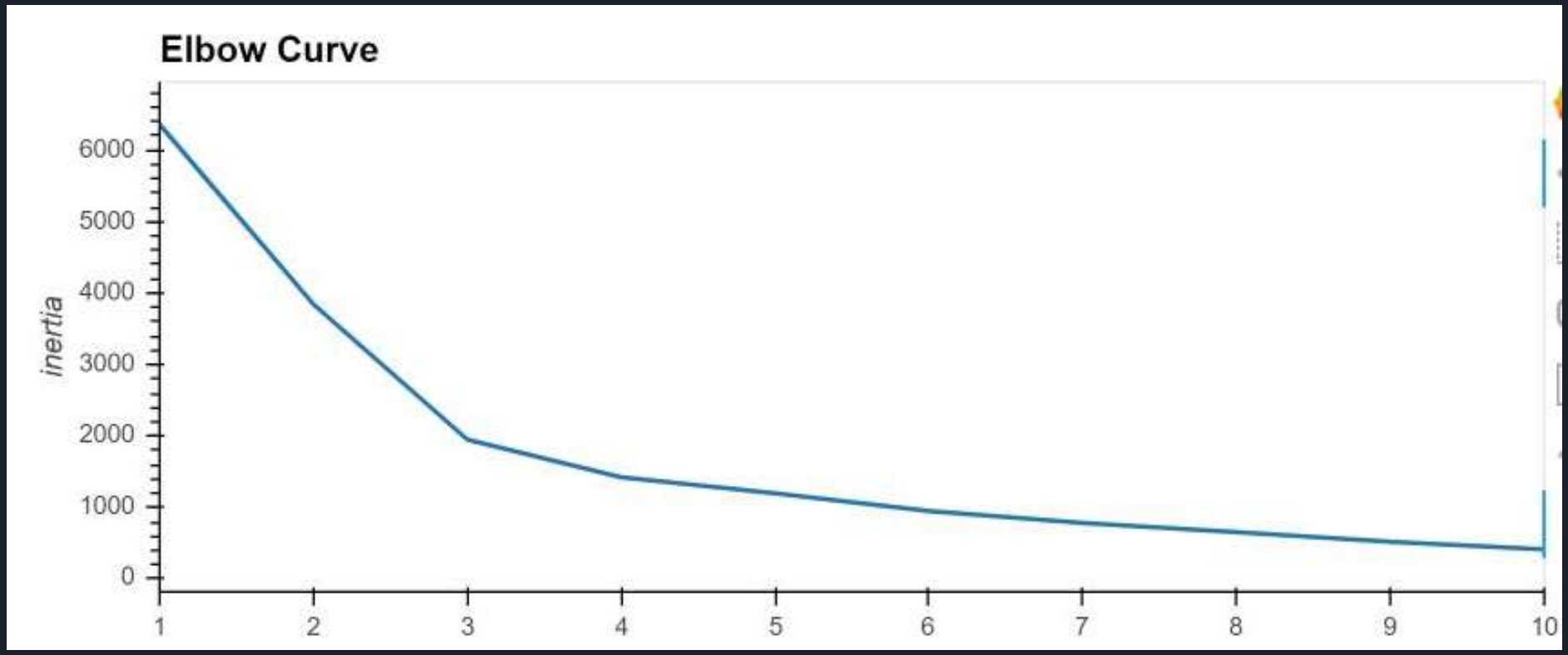
To develop a deeper understanding of the nature of global real estate cycles the project determined the best path forward to both develop meaningfully distinct categories and minimize human bias in the identification of cycles would be to employ K-means Clustering as a way to better understand the structure of the data.

“K Means algorithm is an iterative algorithm that tries to partition the dataset into pre-defined distinct non-overlapping subgroups (clusters) where each data point belongs to only one group. It tries to make the intra-cluster data points as similar as possible while also keeping the clusters as different (far) as possible.”

Source: Towards Data Science



Determining Clusters - Elbow Curve



3 Clusters - Summary Statistics - Reward to Risk

Class 0	
count	11
reward/risk	0.44
mean	2.37%
std	5.44%
min	-6.15
25%	0.07%
50%	1.03%
75%	4.68%
max	14.07%

Class 1	
count	11
reward/risk	-0.09
mean	-0.3%
std	3.19%
min	-6.93%
25%	-1.43%
50%	0.29%
75%	1.53%
max	3.7%

Class 2	
count	11
reward/risk	0.48
mean	3.82%
std	7.88%
min	-5.45%
25%	-0.23%
50%	-0.88%
75%	6.07%
max	22.78%

Qualitative Analysis - Class 1 - lowest reward to risk (part 1)

DATE	Australia	Brazil	China, P.R.: Hong Kong	Denmark	Greece	Indonesia	Japan	Norway	Portugal	Saudi Arabia	United States	class
2019-01-01	0.07	-3.49	2.41	0.02	6.4	0.95	0.7	3.00	0.00	-3.00	5.59	1
2019-04-01	0.06	-3.04	3.35	0.13	6.4	1.50	-0.6	2.50	0.00	-1.83	5.39	1
2019-07-01	0.09	-2.72	-3.44	-0.14	5.4	1.37	0.5	1.60	0.00	-1.20	11.23	1
2019-10-01	0.11	-2.61	-10.44	0.05	5.4	0.32	-0.4	0.90	1.95	-0.10	8.04	1
2020-01-01	0.12	-2.42	-11.68	-0.04	4.1	0.31	-0.6	0.00	0.00	-0.50	5.13	1
2020-04-01	0.09	-2.27	-19.66	-0.11	4.1	0.29	-3.4	0.00	0.00	-1.70	0.81	1
2020-07-01	0.03	-0.91	-17.36	0.04	2.0	0.26	-5.4	0.00	0.00	-2.50	-2.57	1

- Coronavirus
- Unequal global recovery

Qualitative Analysis - Class 1 - lowest reward to risk (part 2)

DATE	Australia	Brazil	China, P.R.: Hong Kong	Denmark	Greece	Indonesia	Japan	Norway	Portugal	Saudi Arabia	United States	class
2016-01-01	0.13	-4.02	0.90	0.01	0.1	2.83	4.8	0.00	0.00	-6.87	-0.62	1
2016-04-01	0.11	-3.05	-5.88	0.01	0.2	1.15	4.0	0.00	0.00	-7.07	-0.29	1
2016-07-01	0.11	-3.69	-8.83	0.01	0.3	0.31	0.9	8.30	0.00	-8.29	3.43	1
2016-10-01	0.11	-3.21	-5.65	-0.08	0.3	-0.17	2.7	8.30	1.98	-12.24	4.58	1

- On January 4 and 7, China's stock market saw a sharp sell-off of about 7 per cent that quickly sent stocks tumbling globally. From January 4 to 15, China's stock market fell nearly 18 per cent.
- Organization of Petroleum Exporting Countries (OPEC) cut its production in November.
- Brexit
- Trump win

Source: The Economic Times, Five events that shook world economy in 2016

Qualitative Analysis - Class 2- highest reward to risk

DATE	Australia	Brazil	China, P.R.: Hong Kong	Denmark	Greece	Indonesia	Japan	Norway	Portugal	Saudi Arabia	United States	class
2015-01-01	0.07	1.74	3.88	-4.75	-6.9	16.20	6.8	2.00	0.00	-1.02	14.61	2
2015-04-01	0.08	0.01	5.85	4.31	-1.9	28.63	4.5	-2.00	0.00	-5.21	13.18	2
2015-07-01	0.11	0.08	8.21	10.65	-0.7	22.60	7.7	-2.00	0.00	-7.29	11.95	2
2015-10-01	0.13	-1.70	6.53	0.12	-0.7	23.69	5.1	0.00	3.53	-8.28	8.31	2

- The US economy grew modestly during 2015. Gross domestic product (GDP) increased only 0.6% in Q1 before improving to 3.9% in Q2 (year over year). Growth slowed to 2.0% in Q3. Q4 GDP growth was forecasted to decline to 1.0% and GDP growth for all of 2015 to average 2.5%.
- In 2015, economic growth was the weakest since the financial crisis. In December, the Organization for Economic Cooperation and Development (OECD) revised its 2015 world growth estimate downward to 2.9%—well below the historical average of 3.6% per year.

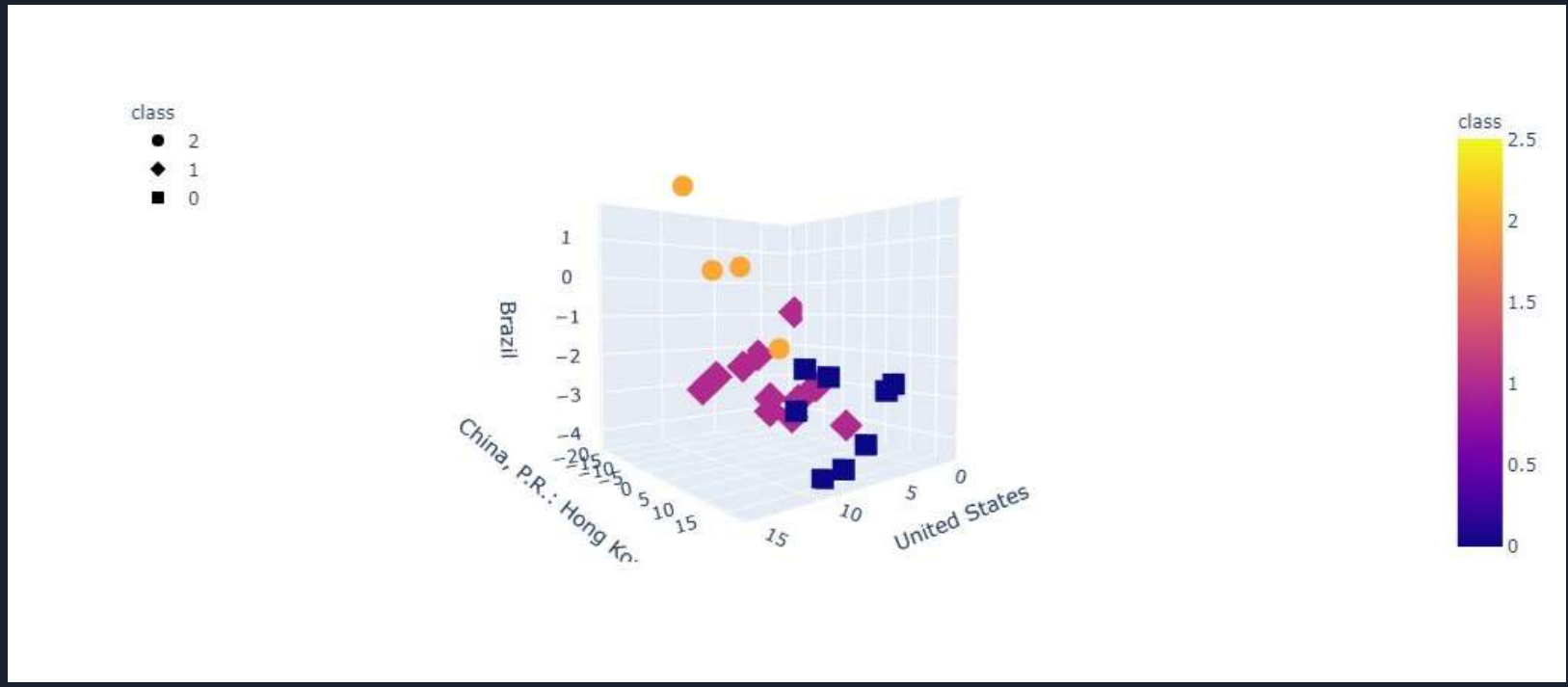
Source: Grunden Financial Advisory, 2015 review, economy and markets

Qualitative Analysis - Class 0- second highest reward to risk

DATE	Australia	Brazil	China, P.R.: Hong Kong	Denmark	Greece	Indonesia	Japan	Norway	Portugal	Saudi Arabia	United States	class
2017-01-01	0.14	-3.19	6.45	0.07	0.7	0.17	2.8	8.30	0.00	-11.67	6.85	0
2017-04-01	0.18	-4.34	15.54	0.07	0.7	0.26	1.0	8.30	0.00	-10.91	8.46	0
2017-07-01	0.16	-3.73	16.99	-0.03	-0.7	0.21	4.2	8.30	0.00	-8.92	5.44	0
2017-10-01	0.16	-4.11	17.52	0.06	-0.7	0.28	6.5	8.30	3.33	-5.63	7.65	0
2018-01-01	0.12	-2.29	12.78	-0.01	3.7	0.93	4.1	3.75	0.00	-4.36	6.74	0
2018-04-01	0.10	-2.07	12.70	-0.04	3.7	0.41	5.9	3.75	0.00	-2.55	8.69	0
2018-07-01	0.09	-2.61	17.32	0.09	7.4	0.52	3.6	9.00	0.00	-2.06	3.74	0
2018-10-01	0.07	-2.62	13.27	-0.06	7.4	1.52	-1.6	10.00	4.88	-3.11	0.73	0

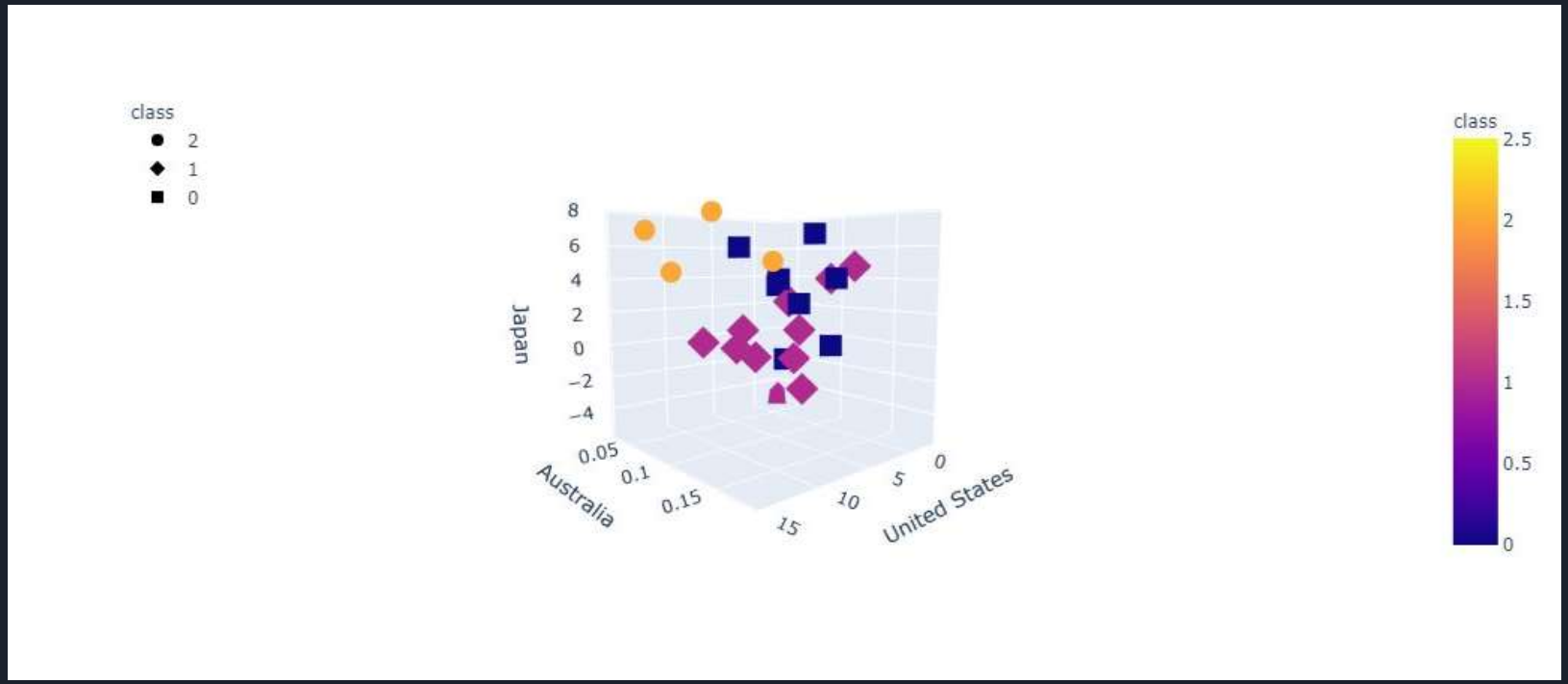
- Global Asset Inflation - Monetary Expansion

Qualitative Analysis - 3D Chart - Frontier/Emerging/Developed



- Class 1 - Diamonds - lowest reward to risk
- Class 2 - Circles - highest risk to reward
- Class 0 - squares - second highest risk to reward

Qualitative Analysis - 3D Chart - All Developed



- Class 1 - Diamonds - lowest reward to risk
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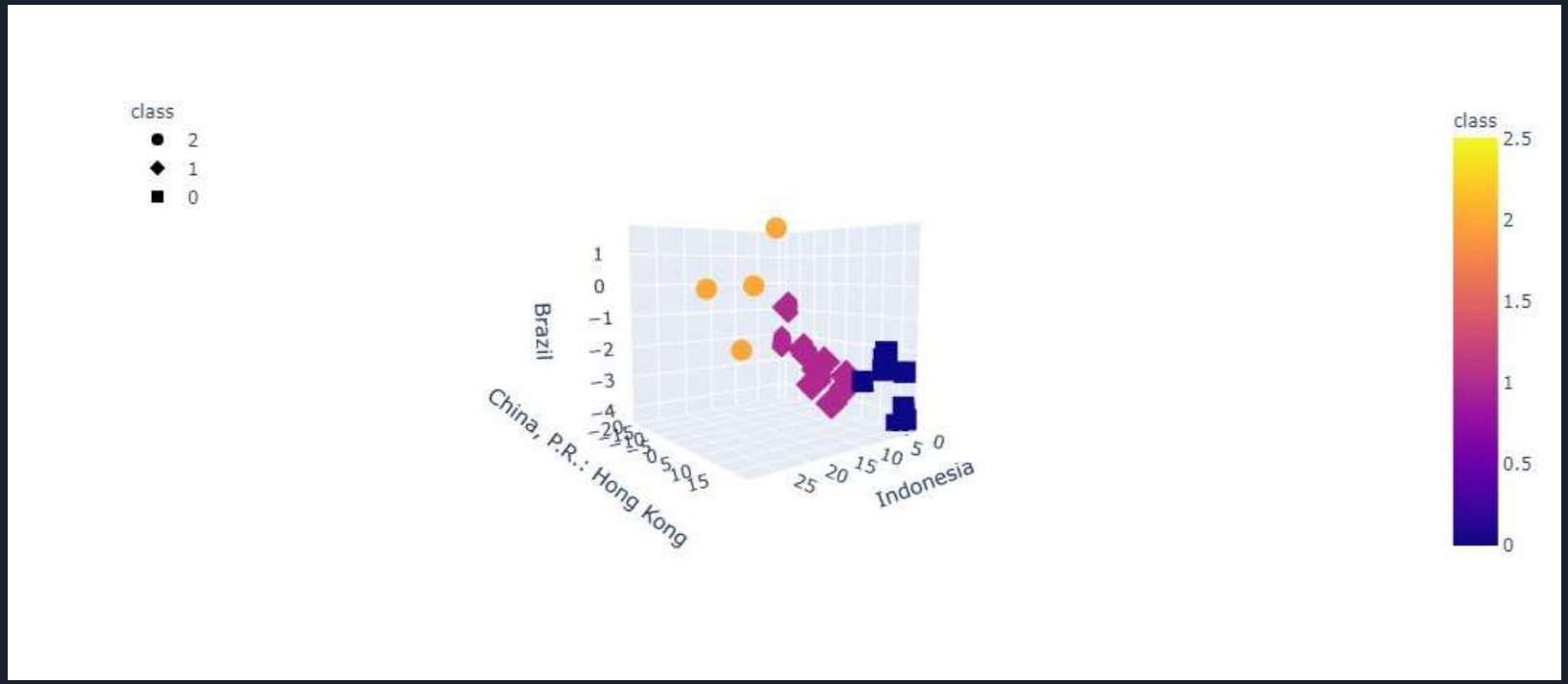
- Class 0 - squares - second highest risk to reward

Qualitative Analysis - 3D Chart - All Frontier/Emerging



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Future Analysis

- Use the classes to develop predictive classification models for real estate investment;
- Use natural language processing to develop more robust qualitative analysis within the classes identified by k-clustering process;
- Add additional countries to form a more complete composite (subject to data availability);
- Adjust the data for inflation so that analysis is on a real returns basis; and
- Weight the various markets based on size, instead of purely on price change.

Q&A